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For ATM SWITCHING SYSTEM AND METHOD FOR SWITCHOVER BETWEEN WORKING CHANNEL AND PROTECTION CHANNEL IN AN ATM NETWORK

Enclosed are:

[X] 4 sheets of drawings.(Figs. 1-7)
[X] Specification, including claims and abstract (16 pages)
[X] Declaration
[X] An assignment of the Invention to FUJITSU LIMITED
[X] A certified copy of Japanese Application No(s). 11-224903
[X] An associate power of attorney
[ ] A verified statement to establish small entity status under 37 CFR 1.9 and 37 CFR 1.27
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[ ] Other _____

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TOTAL CLAIMS	8-20 =	0
INDEP CLAIMS	3-3 =	0
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RATE	FEE
	$345
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X 39 =	$
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TOTAL	$

OTHER THAN A SMALL ENTITY	
RATE	FEE
	$690
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ATM SWITCHING SYSTEM AND METHOD FOR SWITCHOVER BETWEEN WORKING CHANNEL AND PROTECTION CHANNEL IN AN ATM NETWORK

FIELD OF THE INVENTION

The present invention relates to a method for switching over between working channels and protection channels provided in an ATM (asynchronous transfer mode) switching system and equipment in an ATM network.

BACKGROUND OF THE INVENTION

To improve network reliability against failures, the following means have conventionally been applied in an ATM network, where a protection channel is provided in addition to a working channel.

(1) Automatic protection switching (APS) of the physical layer (hereafter referred to as the 'physical layer APS') which is defined in SDH, SONET and the like, or

(2) Path re-establishment and switchover using signaling procedure.

The above methods, however, have disadvantages shown below:

In the method (1), a bandwidth for a protection channel must constantly be reserved corresponding to bandwidth of a physical channel. This reduces efficient use of network resources. In the above method (2), long interruption time against normal service is needed because of substantial time consumption for exchanging signals between nodes, and for executing a software process sequence to search for an idle route and to carry out

path establishment and switchover.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a method and equipment for switchover between a working channel and a protection channel in an ATM network, with a simplified and efficient manner to compensate the aforementioned disadvantage of the physical layer APS.

A method and equipment for addressing the above issue of the present invention to switch over between a working channel and a protection channel in an ATM network includes the following steps: indicating in a cell for transmission whether the cell is object for channel switchover; duplicating the cell in each connection; transmitting the duplicated cell simultaneously both to a working channel and to a protection channel; and selecting a received cell according to an indication whether the cell belongs to a connection currently in working state.

Preferably, a cell not indicated as being in a connection currently in working state is discarded.

Furthermore, preferably, the indication of cell of which connection is not object for the switchover is specified at the unit of a connection group.

Other features of the present invention will be apparent by the following description on the embodiments of the invention referring to the accompanied drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a basic concept of the physical layer APS applied in the present invention.

FIG. 2 shows a configuration diagram of a node C and a node F located at either ends of a protection domain shown in FIG. 1.

FIG. 3 shows a configuration block diagram realizing a functional element of a demultiplexer (DMX) 3-2.

FIG. 4 shows a configuration block diagram of line interface portions 2'-1 to 2'-n in the downstream side of node C shown in FIG. 2.

FIG. 5 shows a configuration block diagram of line interface portions 2-1 to 2-n in the upstream side of node F shown in FIG. 2.

FIG. 6 shows an embodiment for setting an ACT bit into an ACT bit set table 25 promptly to reduce an APS switchover time.

FIG. 7 shows a configuration block diagram of a multiplexer (MUX) 3-1 shown in FIG. 2.

PREFERRED EMBODIMENTS OF THE INVENTION

An embodiment of the present invention is described hereinafter with the accompanied drawings wherein like numerals and symbols refer to like parts.

Prior to explaining the embodiments of the present invention, a basic concept of the 'physical layer APS' is explained first for easier understanding of the invention.

In FIG. 1, a general diagram of the physical layer APS is shown. A node terminating the ATM layer is shown indicating a

situation that a connection is currently established between a node A to a node B. ATM cells each consisting of a header and a payload are transmitted on the connection.

As routes of the connection, a path is being established through nodes C -D -E -F constituting a working channel, and also a path through nodes C -G -H -F constituting a protection channel. The duplicated channel segment consisting of the working channel and the protection channel is called a 'protected domain', to which the physical layer APS is applied.

Note that a transmission path shown in FIG. 1 does not mean a physical line, but the path means a virtual channel on the ATM layer.

In such a network configuration, the physical layer APS is a mechanism to switch over from a working channel to a protection channel in case a failure occurs at an arbitrary point on the working channel. The switchover is generally triggered by the detection of an alarm indicating signal on a virtual path and a virtual channel (VP/VC-AIS; hereafter simply referred to as AIS). The above AIS is detected at a terminating point (node F in the case of FIG. 1) of a segment which is defined as a protected domain of the connection.

For example, when a physical failure such as a breakdown of a fiber transmission line occurs between node C and node D, this situation is detected at node D, producing an AIS cell to forward from node D in the downstream direction (i.e. in the direction toward node F).

Here, the AIS cell is a cell containing an AIS in an ATM

cell header. The AIS cell is detected by node F at which the protected domain is terminated. On this detection, the relevant segment is declared inoperable. At the same time an APS procedure is started.

The APS can be classified into the following schemes with respect to the provision of protection channels. One method is that one protection channel is provided corresponding to each working channel i.e. 1+1 or 1:1 scheme; the other is, using a shared protection channel, either one protection channel shared by n working channels i.e. 1:n scheme, or m protection channels shared by n working channels i.e. m:n scheme ($m \leqq n$).

The difference between 1+1 scheme and 1:1 scheme is that in 1+1 scheme the identical cells are normally transmitted on both a working channel and a protection channel, while in 1:1 scheme cells are transmitted only on a channel currently in working state (i.e. a working channel).

From another aspect, the APS can be classified into a VP/VC-APS method in which a switchover is carried out at the unit of each VP/VC (virtual path and virtual channel) connection, and a VPG/VCG-APS method in which a switchover is carried out at the unit of a group of VP/VC connections.

The object of the present invention is to realize the above-mentioned physical layer APS with a simplified configuration.

In FIG. 2, there is shown a configuration example of a node in accordance with the present invention. The node is located at either end of a protection domain shown in FIG. 1. Only node C and node F are shown in this figure where other intermediate

nodes are omitted.

Each node consists of an ATM switching system which is provided with the following elements: an ATM switch circuit (SW) 1 for performing cell switching function; line interface portions (LINF) 2'-1 to 2'-n for inserting cells, located at the external line side; and line interface portions (LINF) 2-1 to 2-n for extracting cells, located at the internal line side.

Also, there are provided in each node a multiplexer (MUX) 3-1 for multiplexing cells input from line interface portions 2-1 to 2-n, interfacing ATM switch circuit 1; a demultiplexer (DMX) 3-2 for demultiplexing multiplexed ATM cells, also interfacing ATM switch circuit 1; and a controller 4 for performing overall control function.

Referring to FIG. 2, an operation of the physical layer APS in accordance with the present invention is explained hereafter, where 1+1 or 1:1 scheme is taken as an example.

(1) At an initial state, the identical cells are being transmitted on both working channels and protection channels. In node C, a connection for the APS is identified at demultiplexer (DMX) 3-2 under the control of controller 4, to duplicate cells on a working channel side to a protection channel side.

(2) When a failure occurs on a working channel between node C and node D, node D detects the failure and then transmits an AIS cell in the downstream direction toward node F. This AIS cell is detected by node F, of which information is transferred to controller 4.

(3) Controller 4 orders to switch over the connection (ACT) for the APS. Specifically, controller 4 orders ATM switch circuit 1 to switch over from line interface portion (LINF) 2-1 where the working channel is terminated to line interface portion (LINF) 2-i where the protection channel is terminated. More specifically, using a function provided in each line interface portion (LINF) 2-1 to 2-n, an ACT bit in each ATM cell header in transmission is set either 'ON' (which denotes line interface portion 2-i i.e. the protection channel side is in working state), or 'OFF' (which denotes line interface portion 2-1 i.e. the working channel side is in working state).

(4) A mechanism is provided in multiplexer (MUX) 3-1 that the ACT bit in each cell received from line interface portions 2-1 to 2-n is examined to determine whether the cell is to be transmitted. Only cells having proper ACT indication are allowed to transmit. In multiplexer (MUX) 3-1 in node F, a previous condition that only ATM cells received on the working channel are transmitted through and ATM cells on the protection channel are rejected to transmit, is now switched over to that only ATM cells received on the protection channel can be transmitted through. Thus an operation of the physical layer APS is completed.

According to the present invention, the following functional elements are provided for realizing a sequence of operation described above in an ATM node;

(1) in demultiplexer (DMX) 3-2, duplicating cells on a working channel to a protection channel side at the unit of

either a connection or a connection group,

(2) in line interface portions 2-1 to 2-n, providing each ATM cell header with an ACT bit for specifying ACT (in working condition) at the unit of either a connection or a connection group, and

(3) in multiplexer (MUX) 3-1, transmitting only cells of which ACT is specified in each cell header.

A detailed embodiment of the functional elements (1) to (3) above is described hereinafter.

In FIG. 3, a functional element of demultiplexer (DMX) 3-2 provided in each node is shown.

In this FIG. 3, Tag-B is a tag provided in an ATM cell header for identifying an output channel. O-ICID-A is also provided in the ATM cell header, which is an 'internal channel identifier' for identifying a channel in an output channel indicated by Tag-B.

An APS identifier is also provided in the ATM cell header which enables to determine whether a connection (or a connection group) of the relevant cell is object for the APS processing or not.

The tag and the internal channel identifier explained above are set into an ATM cell header at either line interface portions 2-1 to 2-n and 2'-1 to 2'-n, multiplexer (MUX) 3-1, or ATM switch circuit 1, under the control of controller 4.

For example, in node C shown in FIG. 3, an APS identifier in an ATM cell input to demultiplexer (DMX) 3-2 is examined. If this APS identifier indicates the cell is object for the APS

(i.e. APS is 'ON'), then a cell duplication table 30 is referred to, using Tag-B and O-ICID-A as the reference keys.

Through the above procedure, information on an output line Tag-B(P) to be used for an protection channel and a channel O-ICID-A(P) in the above output line is obtained. Then the ATM cell is duplicated and the information on an output line and a channel in the duplicated cell are respectively replaced by Tag-B(P) and O-ICID-A(P), to output to a cell buffer (FIFO) 31.

In FIG. 4, there is illustrated a configuration block diagram of line interface portion 2-i on the internal line side which is provided in node D, for example, located in the downstream direction against node C. In this FIG. 4, O-VPI/VCI is stored in a cell header, showing a value of VPI/VCI (virtual path and virtual channel identifier) of an output line related to the cell.

Using as a reference key an internal line and channel identifier O-ICID-A in an input ATM cell, a VPI/VCI conversion table 21 is referred to. Then, VPI/VCI to be forwarded to an external line is obtained from VPI/VCI conversion table 21.

The obtained VPI/VCI is set into the ATM cell header in a header modification portion 22, to forward to the external transmission line.

Also, in line interface portion 2-i on the internal line side, there is provided an alarm cell insertion circuit 20 to insert an alarm cell named VP/VC-AIS. When a failure occurs between node C and node D, and node D detects this failure, an alarm cell is inserted according to a control command issued

from controller 4.

Here, an alarm cell is a kind of ATM cell in which an alarm indicating signal (AIS) is set in an ATM cell header. The alarm cell is detected in the downstream node (for example, node F in the network configuration shown in Fig. 1) to trigger THE APS operation.

In FIG. 5, there is shown a block diagram of a configuration example related to the input side of line interface portion 2-1 in node F which constitutes a terminal node of a protected domain. By referring to an ICID conversion table 23 using VPI/VCI, which is an external virtual path and virtual channel identifier stored in a header of an input ATM cell, as a reference key, a corresponding internal virtual path and virtual channel identifier, I-ICID-A, is obtained.

The reason of the above processing is that VPI/VCI composed of 22 bits requires large amount of circuits to process in ATM switch circuit 1. Therefore, VPI/VCI is converted into I-ICID-A which is a condensed form of the internal path and channel identifier. A header modification portion 24 replaces with the obtained I-ICID-A in an ATM cell header which.

Then, using the obtained I-ICID-A as a reference key, an APS identifier set table 25 is referred to. Depending on 'ON' or 'OFF' of an APS bit in APS identifier set table 25, whether the corresponding internal path and channel is object for the APS or not is determined.

Furthermore, using the value of I-ICID-A as a reference key, an ACT bit set table 26 is referred to. The ACT bit indicates

whether each object cell for the APS is actually to be transmitted to a destination terminal.

The APS bit and the ACT bit which have been referred to are attached to an ATM cell header by a header modification portion 27.

Values in those tables for determining that a cell is object for the APS etc. are set by an order from controller 4 either in advance or in case necessary.

Furthermore, in FIG. 5, an alarm cell extraction portion 28 is provided for extracting an alarm cell sent from an upstream node to inform to controller 4.

In FIG. 6, there is shown an embodiment for setting APS identifier set table 25 and ACT bit set table 26 by an order from controller 4 which is carried out in a procedure after the APS is started. The embodiment intends to shorten the required time for an APS switchover by setting ACT bit set table 25 with high-speed.

In FIG. 5, when an APS switchover occurs, it is necessary to rewrite all data related to the corresponding connection in ACT bit set table 25, which may necessitate large processing time.

On the other hand, according to the configuration shown in FIG. 6, a table 25 is provided for use of setting ACT bits at the unit of an APS group (APS-Gr.). This enables to set the table from controller 4 at the unit of APS group i.e. in a batch of lines, instead of individual line by line, with less processing time.

In order to refer to this table 25, information is required to identify which APS group each connection belongs to. For this purpose, an APS group conversion table 29 is provided for obtaining APS-Gr from I-ICID-A having been extracted from ICID conversion table 23. Each APS group is generally assigned corresponding to each outgoing line of ATM switch circuit 1.

Using an APS group obtained from APS group conversion table 29, an APS identifier set table 26 is referred to. Also ACT bit set table 25 is referred to using an APS group obtained from APS group conversion table 29.

In FIG. 7, there is shown a configuration block diagram of multiplexer (MUX) 3-1 shown in FIG. 2. Among ATM cells received from each channel route SHW0 to SHWn, only ATM cells received on a protection channel side having 'ON' in each ACT bit are transmitted through cell invalidation circuits 32-1 to 32-n. ATM cells transmitted through are then multiplexed by a multiplexing circuit 33 to forward to ATM switch circuit 1.

Having been explained referring to the accompanied drawings, the present invention provides a concrete configuration for realizing ATM layer protection switching (APS). An ATM switching system according to the present invention can be provided with simple configuration.

The foregoing description of the embodiment is not intended to limit the invention to the particular examples. Any suitable modification may be resorted to the scope of the invention. All features and advantages of the invention which fall within the scope of the invention are covered by the appended claims.

What is claimed is:

1. A method for switching over between a working channel and a protection channel in an ATM network comprising the steps of:

indicating in a cell for transmission whether a connection of said cell is object for a switchover;

duplicating said cell at the unit of a connection;

transmitting the duplicated cells simultaneously to a working channel and a protection channel;

indicating whether each cell belongs to a connection currently in a working state; and

selecting a received cell which is included in the connection in a working state.

2. A method for switching over between a working channel and a protection channel according to claim 1, wherein a cell having an indication of a connection currently not in a working state is discarded.

3. A method for switching over between a working channel and a protection channel according to claim1, wherein an indication whether said cell for transmission is included in a connection object for a channel switchover is provided in said cell at the unit of a connection group.

4. ATM switching equipment having a switchover function

between a working channel and a protection channel, said ATM switching equipment comprising:

a demultiplexer having functions of indicating in a cell for transmission whether said cell is object for a switchover, duplicating said cell at the unit of a connection, and transmitting the duplicated cells simultaneously to a working channel and a protection channel; and

a line interface means for selecting a received cell according to the indication whether said cell is included in a connection currently in a working state.

5. ATM switching equipment according to claim 4, wherein said cell having an indication of a connection currently not in a working state is discarded.

6. ATM switching equipment according to claim 4, wherein an indication whether said cell for transmission is included in a connection object for a switchover is provided in said cell at the unit of a connection group.

7. ATM switching equipment provided in an ATM network node comprising:

a means for duplicating a cell at the unit of a connection;

a means for transmitting the duplicated cells simultaneously to a working channel and a protection channel; and

a table for indicating, at the unit of either a connection

or a connection group, whether a received cell is included in a connection currently in a working state using an ACT bit provided in a cell header,

enabling to select a received cell referred to by said table according to the indication whether said received cell is included in a connection currently in a working state.

8. ATM switching equipment according to claim 7 further comprising:

a means for invalidating a received cell referred to by said table in the case said cell has an indication of being included in a connection currently not in a working state.

ABSTRACT

A method and ATM switching equipment are provided for switching over between a working channel and a protection channel in an ATM network. The physical layer APS (automatic protection switching) is basically adopted with a simplified means. The method includes the following process: An indication is provided in each cell for transmission whether the cell belongs to a connection currently in a working state via a working channel. Cells are duplicated on each connection basis. The duplicated cells are transmitted simultaneously onto both a working channel and a protection channel. Valid cells are selected from received cells according to the indication in each cell whether the relevant connection is currently in a working state.

FIG. 1

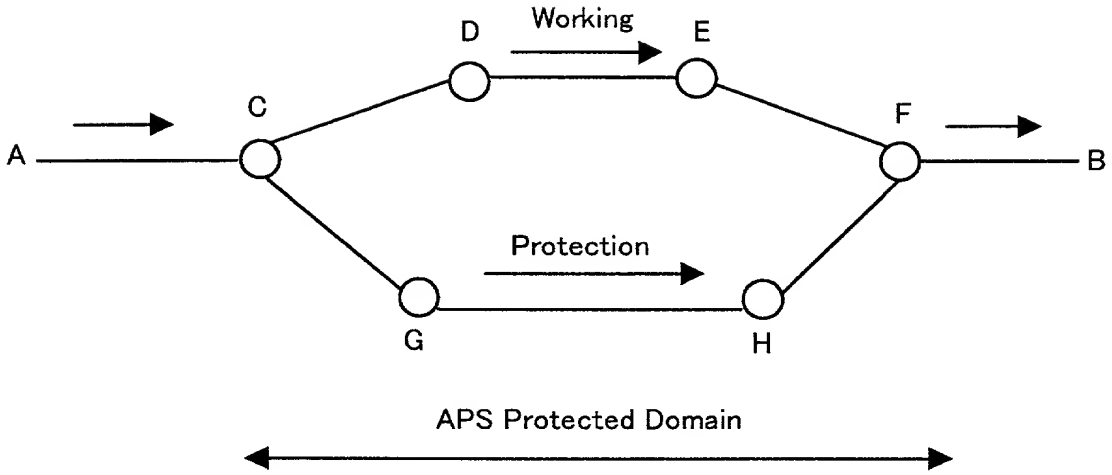
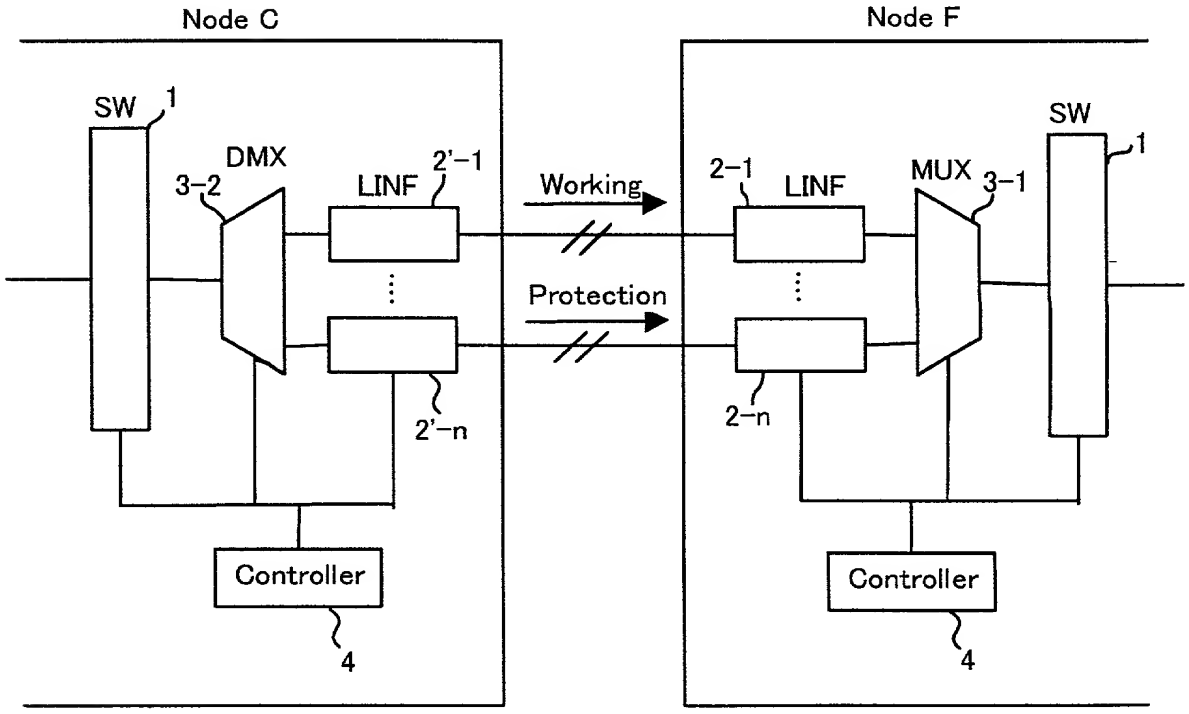


FIG. 2



SW:ATM Switch
DMX:Demultiplexer
MUX:Multiplexer
LINF:Line Interface

FIG. 3

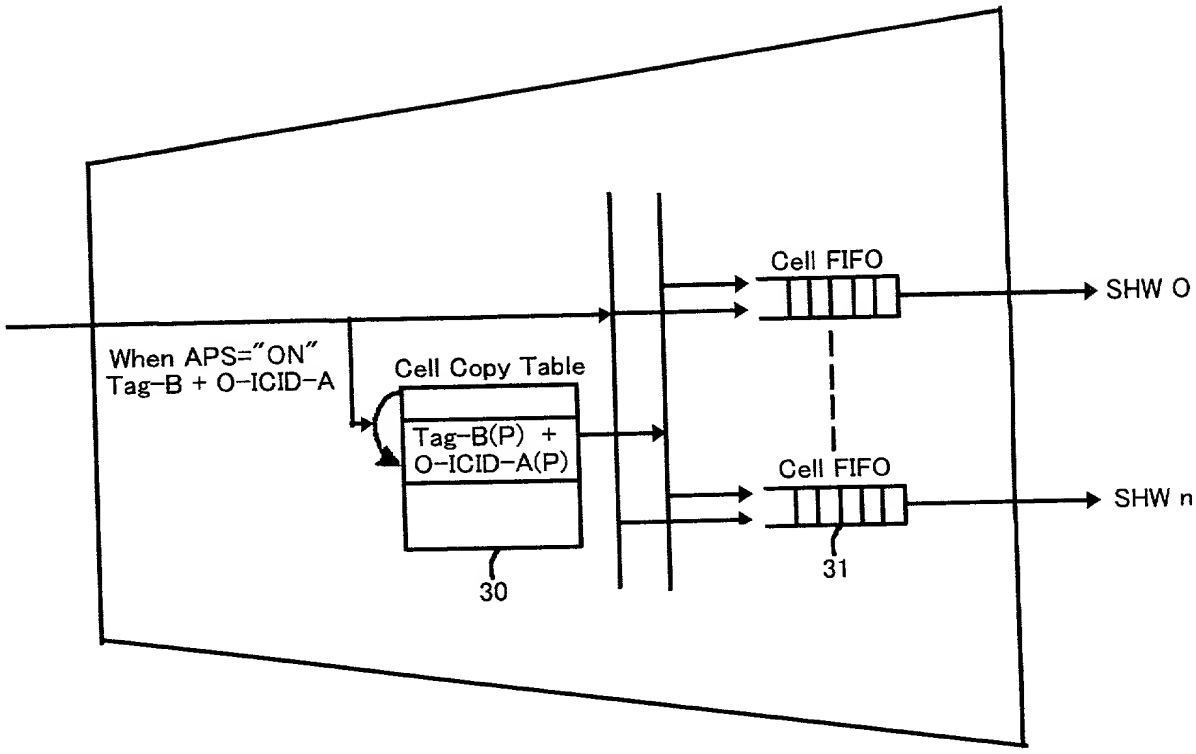

When APS="ON"
Tag-B + O-ICID-A
Cell Copy Table
Tag-B(P) +
O-ICID-A(P)
30
Cell FIFO
SHW O
Cell FIFO
SHW n
31

FIG. 4

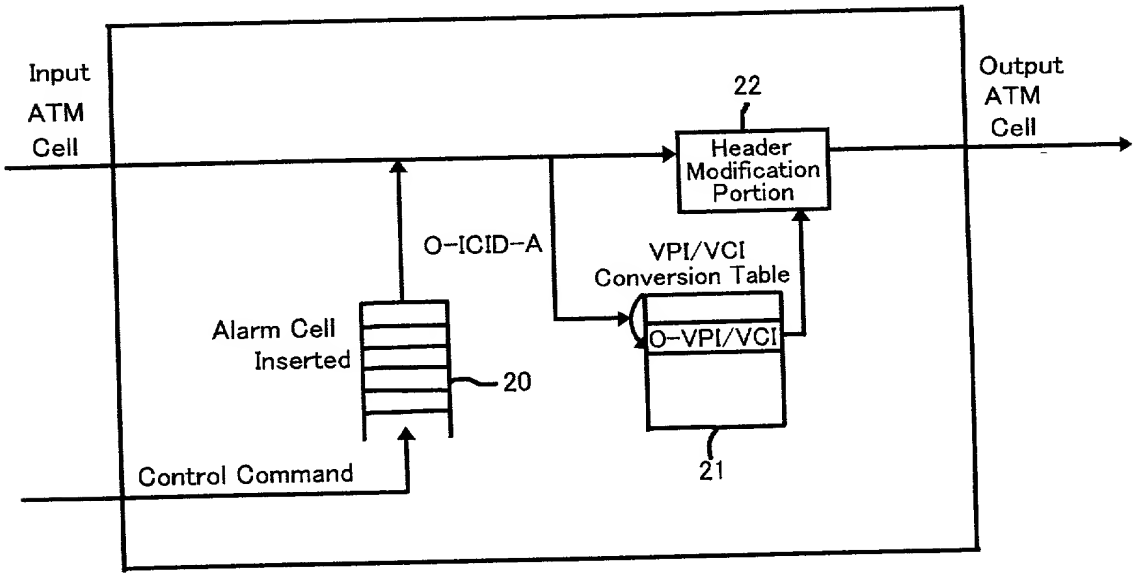

Input
ATM
Cell
22
Header
Modification
Portion
Output
ATM
Cell
O-ICID-A
VPI/VCI
Conversion Table
O-VPI/VCI
Alarm Cell
Inserted
20
Control Command
21

FIG. 5

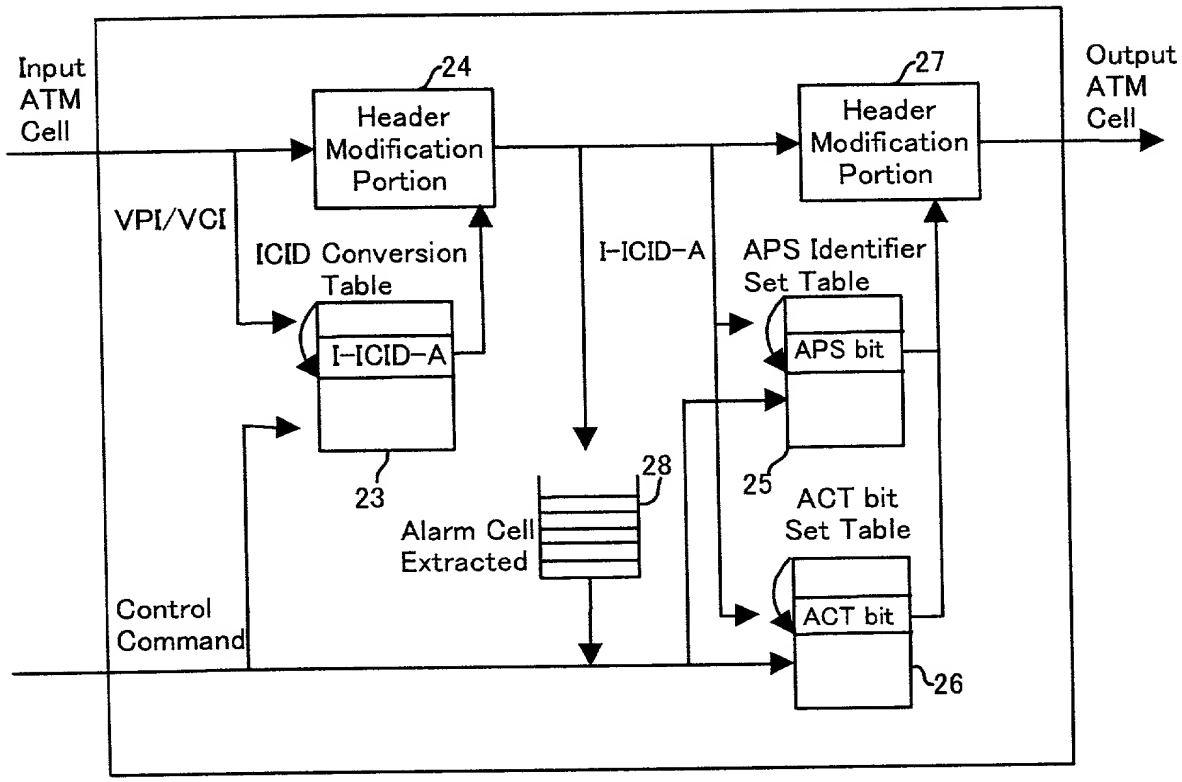

Input ATM Cell
24
Header Modification Portion
27
Header Modification Portion
Output ATM Cell
VPI/VCI
ICID Conversion Table
I-ICID-A
APS Identifier Set Table
APS bit
I-ICID-A
23
28
25
ACT bit Set Table
Alarm Cell Extracted
Control Command
ACT bit
26

FIG. 6

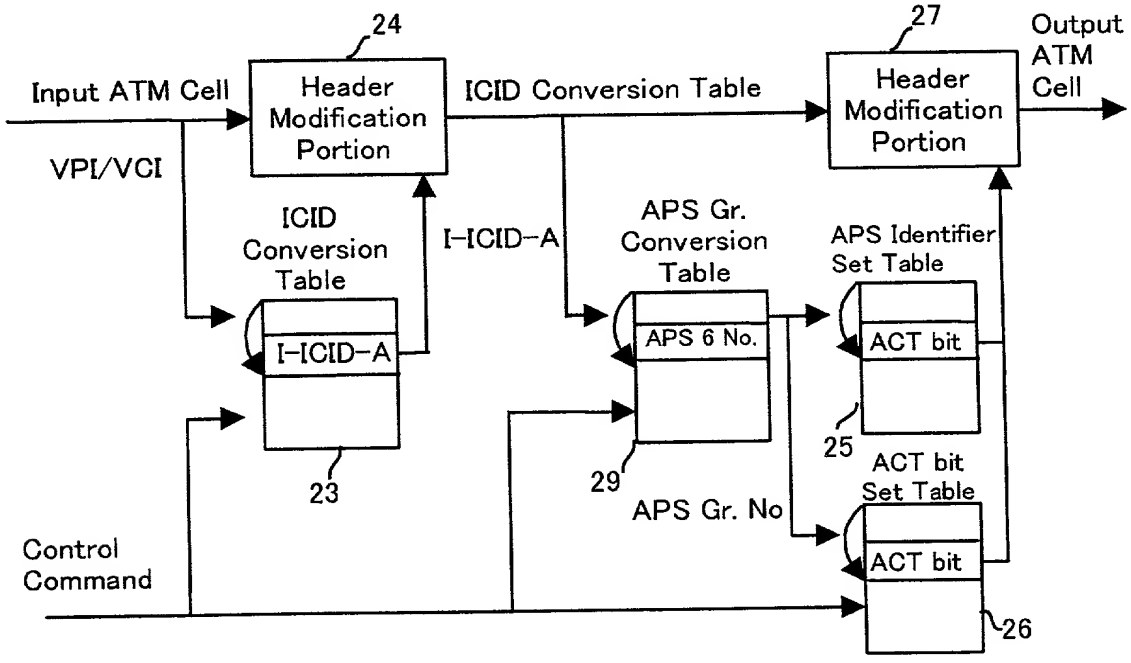
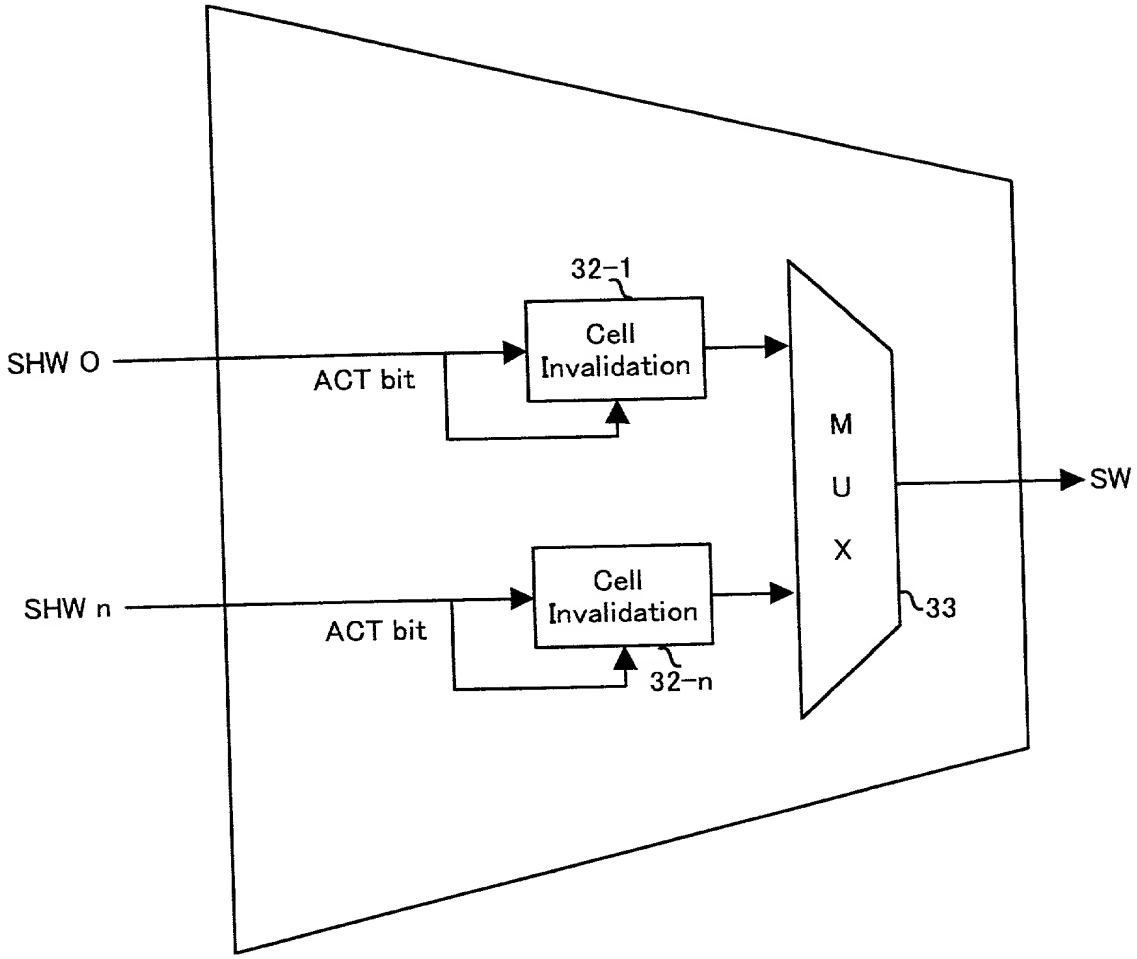

24
Input ATM Cell
Header Modification Portion
ICID Conversion Table
27
Header Modification Portion
Output ATM Cell
VPI/VCI
ICID Conversion Table
I-ICID-A
APS Gr. Conversion Table
APS Identifier Set Table
I-ICID-A
APS 6 No.
ACT bit
23
25
29
ACT bit Set Table
APS Gr. No
Control Command
ACT bit
26

FIG. 7


32-1
Cell Invalidation
SHW 0
ACT bit
M
U
X
SW
SHW n
ACT bit
Cell Invalidation
33
32-n

DOCKET NO.: FUJH 17.615

PTO/SB/106 (8-96)
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Japanese Language Declaration

日本語宣言書

下記の氏名の発明者として、私は以下の通り宣言します。

As a below named inventor, I hereby declare that:

私の住所、私書箱、国籍は下記の私の氏名の後に記載された通りです。

My residence, post office address and citizenship are as stated next to my name.

下記の名称の発明に関して請求範囲に記載され、特許出願している発明内容について、私が最初かつ唯一の発明者（下記の氏名が一つの場合）もしくは最初かつ共同発明者であると（下記の名称が複数の場合）信じています。

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

ATM SWITCHING SYSTEM AND METHOD FOR SWITCHOVER BETWEEN WORKING CHANNEL AND PROTECTION CHANNEL IN AN ATM NETWORK

上記発明の明細書（下記の欄でx印がついていない場合は、本書に添付）は、

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☐ __月__日に提出され、米国出願番号または特許協定条約国際出願番号を_____とし、
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as United States Application Number or
PCT International Application Number
_____ and was amended on
_____ (if applicable).

私は、特許請求範囲を含む上記訂正後の明細書を検討し、内容を理解していることをここに表明します。

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

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I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

PTO/SB/106 (8-96)
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Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Japanese Language Declaration
(日本語宣言書)

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I hereby claim foreign priority under Title 35, United States Code, Section 119 (a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)
外国での先行出願

(Number) (番号)	(Country) (国名)	(Day/Month/Year Filed) (出願年月日)	Priority Not Claimed 優先権主張なし
11-224903	JAPAN	09/08/1999	☐
			☐

私は、第３５編米国法典１１９条(e)項に基いて下記の米国特許出願規定に記載された権利をここに主張いたします。

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below.

(Application No.) (出願番号)	(Filing Date) (出願日)	(Application No.) (出願番号)	(Filing Date) (出願日)

私は、下記の米国法典第３５編１２０条に基いて下記の米国特許出願に記載された権利、又は米国を指定している特許協力条約３６５条(c)に基ずく権利をここに主張します。また、本出願の各請求範囲の内容が米国法典第３５編１１２条第１項又は特許協力条約で規定された方法で先行する米国特許出願に開示されていない限り、その先行米国出願書提出日以降で本出願書の日本国内または特許協力条約国際提出日までの期間中に入手された、連邦規則法典第３７編１条５６項で定義された特許資格の有無に関する重要な情報について開示義務があることを認識しています。

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s), or 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code Section 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of application.

(Application No.) (出願番号)	(Filing Date) (出願日)	(Status: Patented, Pending, Abandoned) (現況：特許許可済、係属中、放棄済)

私は、私自身の知識に基ずいて本宣言書中で私が行なう表明が真実であり、かつ私の入手した情報と私の信じるところに基ずく表明が全て真実であると信じていること、さらに故意になされた虚偽の表明及びそれと同等の行為は米国法典第１８編第１００１条に基ずき、罰金または拘禁、もしくはその両方により処罰されること、そしてそのような故意による虚偽の声明を行なえば、出願した、又は既に許可された特許の有効性が失われることを認識し、よってここに下記のごとく宣誓を致します。

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

PTO/SB/106 (8-96)
Approved for use through 9/30/98. OMB 0651-0032
Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Japanese Language Declaration
(日本語宣言書)

委任状： 私は下記の発明者として、本出願に関する一切の手続きを米特許商標局に対して遂行する弁理士または代理人として、下記の者を指名いたします。（弁護士、または代理人の氏名及び登録番号を明記のこと）

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith *(list name and registration number)*

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発明者の署名 日付	Inventor's signature Date Naoki Aihara 25/07/2000
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(Supply similar information and signature for third and subsequent joint inventors.)

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第六共同発明者		Full name of sixth joint inventor, if any
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（第七以降の共同発明者についても同様に記載し、署名をすること）

(Supply similar information and signature for seventh and subsequent joint inventors.)

THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of: **Naoki AIHARA et al.**

Filed : **Concurrently herewith**

For : **ATM SWITCHING SYSTEM AND METHOD FOR SWITCHOVER BETWEEN WORKING CHANNEL AND PROTECTION CHANNEL IN AN ATM NETWORK**

Serial No. : **Concurrently herewith**

August 9, 2000

Assistant Commissioner of Patents
Washington, D.C. 20231

SUB-POWER OF ATTORNEY

S I R:

I, Samson Helfgott, Reg. No. 23,072 attorney of record herein, do hereby grant a sub-power of attorney to Linda S. Chan, Reg. No. 42,400, Jacqueline M. Steady, Reg. No., 44,354 and Harris A. Wolin, Reg. No. 39,432 to act and sign in my behalf in the above-referenced application.

Respectfully submitted,

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